A Massive Star Odyssey, from Main Sequence to Supernova
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The Evolutionary Stage of 5 Southern Galactic Unclassified B[e] Stars

Marcelo Borges Fernandes, Francisco X. de Araújo

Observatório Nacional, Rua General José Cristino, 77, CEP: 20921-400, São Cristóvão, Rio de Janeiro, Brasil

H.J.G.L.M. Lamers

Astronomical Institute, Utrecht University, P.O. Box 80000, NL-3508, TA, Utrecht, The Netherlands

Abstract. The spectra of stars with the B[e] phenomenon are dominated by features that are related to physical conditions of circumstellar material around these objects and are not intrinsic to the stars. Because of this, they form a very heterogeneous group. This group contains objects with different evolutionary stages. Lamers et al. (1998) have suggested a new designation with five sub-groups, which indicate the evolutionary stage. They are: supergiants, pre-main sequence or Herbig Ae/Be, compact planetary nebulae, symbiotic and unclassified. The unclassified group has many objects that need a better study to resolve their evolutionary status. Forbidden lines can be a useful tool to solve this problem. They can give informations about chemical composition, ionization and density of the circunstellar medium and probably the evolutionary phase of these objects. We analize spectra of some galactic objects, obtained with FEROS and B&C spectrograph at 1.52 telescope in ESO (La Silla-Chile), with a special focus on the forbidden lines. We have studied the spectra of 5 B[e] stars of uncertain evolutionary stage. We find that one of them is a pre-WN star, the other four are supergiant B[e] stars.

1. Forbidden Lines

The presence of some forbidden lines is a criterion to distinguish differents groups of massive stars. For example, LBV and sgB[e] have similar spectral characteristics, however, [OI] lines are present only in the sgB[e] (Zickgraf, 1989). Below, we have a table showing the presence (Yes) or not (No) of some important forbidden lines. Figure 1 shows the profiles of forbidden and permitted NII lines in the spectra of HD 326823.

Objects	[OI]	[OII]	[OIII]	[SII]	[NII]	[FeII]
HD 87643	Yes	No	No	Yes	No	Yes
Hen 3-847	Yes	No	No	Yes	Yes	Yes
GG Car	Yes	No	No	No	Yes	Yes
MWC 300	Yes	No	No	Yes	Yes	Yes
HD 326823	No	No	No	Yes	Yes	Yes

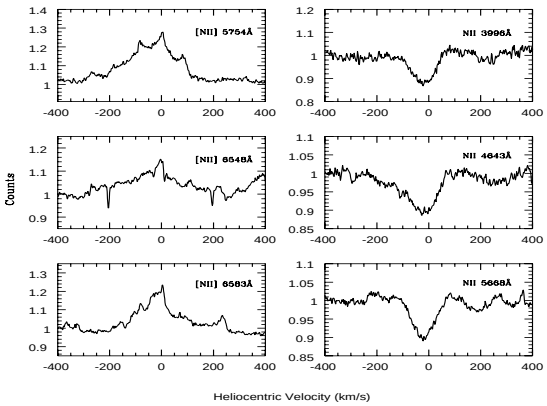

Figure 1 -Profiles of NII lines in the high resolution spectrum (FEROS-agreement ESO/ON) of HD 326823. The permitted lines are in absorption, indicating a photospheric origin, and the forbidden are in emission, indicating a circumstellar origin.

2. The Evolutionary Phase of unclB[e] Stars

From the comparison with spectra of well-stabilished groups, it is possible to derive the evolutive stage of these 5 unclB[e].

HD 326823 - The He overabundance indicates that it is an evolved star. In agreement with the literature, we suggest that is a pre-WN star with the B[e] phenomenon (Fernandes et al. 2001). This suggests a new class of B[e] stars.

HD87643 - There is a doubt if it is a pre-main sequence or a supergiant object. The absence of inverse P-Cygni profiles and absence of a strong variability suggest an evolved star, as sgB[e].

Hen 3-847 - This object used to be classified as a pre-main sequence star. However, our spectra do not show any characteristic feature of young objects. We suggest that it is a sgB[e] candidate.

GG Car - This star was classified as sgB[e], but some authors consider it as a binary system, with a B star and a K star. Our spectra do not show any feature from the late type star. So we suggest that it is a sgB[e].

MWC 300 - This object is classified, in the literature, as sgB[e] candidate. Our analysis of its spectrum confirms that suggestion.

We have already started a study of the physical properties and parameters of the circumstellar material of those objects. The full result of this study will be published in A&A by the same authors.

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